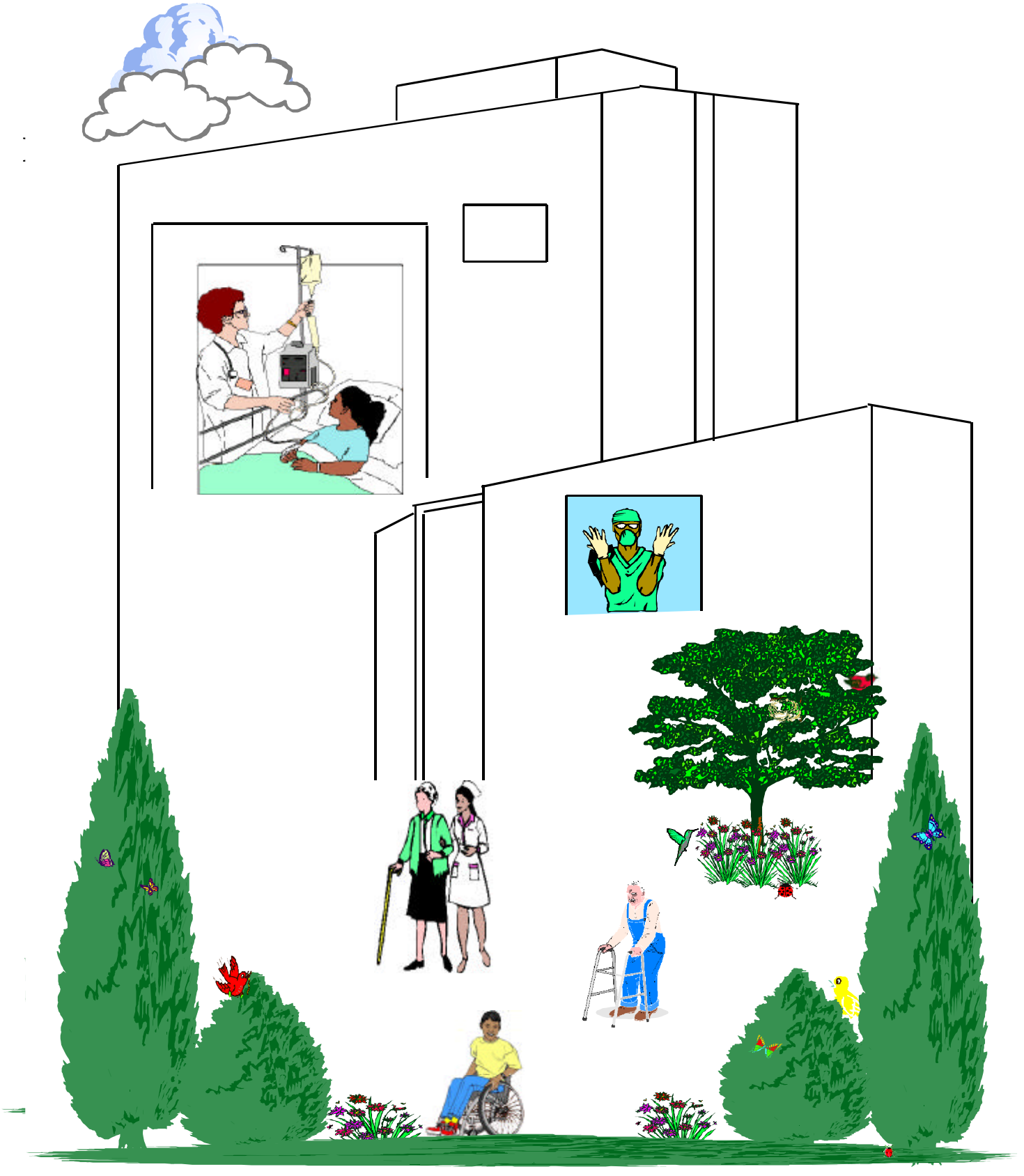
State of Louisiana
Methicillin - Resistant Staphylococcus Aureus (MRSA)
Guidelines for Acute and Extended Care Facilities



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Methicillin - Resistant Staphylococcus Aureus (MRSA) Guidelines for Acute and Extended Care Facilities

1992-1993 Louisiana Statewide MRSA Advisory Committee

Cover by Ann Brown

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I. INTRODUCTION

Infection with strains of *Staphylococcus aureus* that are resistant to methicillin or oxacillin (commonly known as Methicillin-resistant *S. aureus*, or MRSA) are increasingly common in hospitals and nursing homes. Because these organisms are resistant to most antibiotics, the infections are particularly difficult to treat. At the same time, employees and patients of institutions may become asymptomatically colonized with MRSA, and may serve as a source for infection in others. Outbreaks of MRSA infections in institutions are not uncommon. As a result, MRSA infections are often the source of a great deal of concern in institutions.

Many institutions now take extensive measures to limit the introduction or spread of MRSA among their patients and staff. Some of these measures are successful in containing the problem of MRSA. However, some have led to problems in other institutions. In particular, there have been problems regarding transfer of MRSA-infected or -colonized patients between institutions. In addition, there is wide variation among institutions and medical providers in methods of treatment, infection-control policies, handling of colonized patient and staff, outbreak control, and prevention. In some instances MRSA is not viewed seriously enough and outbreaks continue without appropriate response, and in others MRSA is viewed with such fear that costly and unnecessary precautions are undertaken. It is the purpose of these guidelines to educate persons working in institutions in Louisiana regarding MRSA and to establish some uniformity of procedures for prevention, surveillance, diagnosis, treatment, patient transfer, infection control, and outbreak management.

BASIC FACTS ABOUT MRSA

What is *Staphylococcus aureus?*

Staphylococcus aureus is a gram-positive coccus that thrives on human skin and mucous membranes, grows rapidly under either aerobic or anaerobic conditions, and can be carried by its host for long periods of time without causing clinical consequences. However, if given the opportunity, *S. aureus* can be responsible for a variety of serious diseases, most notably pneumonia, cellulitis, suppurative wound infections, abscesses, and sepsis. The organism also elaborates toxins which cause such diverse manifestations as gastroenteritis and toxic shock syndrome. It is important to note the distinction between *S. Aureus* which is coagulase positive and the coagulase negative Staphylococcus which includes *Staphylococcus epidermidis*, the most common organism found on the skin. In immunocompetent patients and patients without invasive devices, a surface culture of *S. epidermidis* is usually a contaminant and not a pathogen.

What is the difference between colonization and disease?

Persons who have *S. aureus* on their skin and/or mucous membranes on repeated cultures but who have no symptoms are called Acolonized@ with this organism. Persons may be colonized transiently or for long periods of time. Persons who have signs or symptoms (such as fever or purulent discharge) and have positive cultures are called infected.

How is it spread?

Staphylococci are transmitted by direct skin-to-skin contact. The source of infection may be a person with infection or a person that is colonized. Usually the organism spreads from hands of the infected/colonized person to the skin of another person. In general, transmission of staphylococci does not occur by the airborne route or through contaminated objects (Afomites@). **Therefore the single best way to prevent transmission of staphylococci is routine handwashing.**

What is methicillin-resistance?

At one time staphylococci could be easily treated with penicillin, but most strains now produce an enzyme that makes penicillin ineffective. To combat this, pharmaceutical researchers have produced a series of semi-synthetic penicillins which are not affected by this enzyme and which can successfully treat infections with *Staphylococcus aureus*. These drugs - oxacillin, nafcillin, and methicillin - are the main drugs used to treat infections with *S. aureus*. However, some strains of this organism are resistant to these three drugs; they are collectively called methicillin-resistant *Staphylococcus aureus* (MRSA), although they are resistant to all these three semi-synthetic penicillins. Infections caused by MRSA are very difficult to treat with standard antibiotics; many can only be treated with vancomycin intravenously. It is this difficulty in treating these infections that causes much of the concern about MRSA. However, MRSA is not inherently more contagious than other strains of Staphylococcus that are sensitive to methicillin.

Why is it more frequent now?

It is not known why MRSA appears to be more frequent in recent years. However, it is possible that as more broad-spectrum antibiotics are developed and put into wide use, other bacteria (pathogenic or not) are no longer present to compete with MRSA, allowing MRSA the opportunity to multiply and infect other sites or other persons. In any case, the increase in MRSA is a national problem that is not likely to end soon.

THE MRSA ADVISORY COMMITTEE

Many persons working in health care in Louisiana recognized the increasing problem of MRSA infections in nursing homes and hospitals. Because the Louisiana Office of Public Health (OPH) was often asked to provide guidance to these persons, and because no up-to-date guidelines from national agencies were available, in 1992 OPH convened a state MRSA advisory committee. The purpose of this committee was to review the problem of MRSA in Louisiana and make recommendations regarding control of MRSA in institutions that could be used statewide. The advisory committee included members of acute-care and long-term care institutions, physicians, representatives of regulatory agencies, infection control nurses, and epidemiologists. In the fall of 1992 the committee reviewed the problem and recommendations of other states and during 1993 it developed these guidelines. The guidelines represent the best recommendations the committee felt it could make at this time. Not all members supported all recommendations in the guidelines, but the final draft represents the consensus of this committee.

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II. RECOMMENDATIONS

A. COMPREHENSIVE PATIENT CARE CONSIDERATIONS

1. Hospital Admission

MRSA colonization does not warrant hospital admission. Hospital admission for treatment of MRSA infection is acceptable medical practice. While treatment for MRSA infection is often best accomplished in an acute-care setting, special situations may warrant treatment for infection in a nursing home/extended-care facility or even at home. This decision should be made based on the clinical judgment of the attending physician, possibly with the input of an infectious disease consultant.

In hospitals, The MRSA colonized patient can be placed with another MRSA colonized patient if one has been identified, but this is not mandatory. However, the patient should not be placed in a room with a patient who is at high risk for MRSA infection (i.e., patient with a decubitus, surgical wound, open wound, intravenous line, tracheostomy, gastrostomy tube, urinary catheter, severe underlying disease or immunocompromised).

2. Transfer from Hospital to Nursing Home/Extended-Care Facility

A patient with clinical MRSA infection can be discharged to a nursing home/extended-care facility under special circumstances, provided clinical judgment, familial consent, and nursing home administration agree. Hospitals can transfer patients with active infection to nursing homes/extended-care facilities if the clinical manifestations of infection show signs of improvement and if the nursing home/extended-care facility is equipped to manage the wound and necessary antibiotic therapy. Denial of admission to a nursing home/extended-care facility should be based on medical eligibility, not on culture results.

A patient colonized by MRSA while hospitalized should be discharged once that accompanying medical condition is under control. Thus, a patient colonized with MRSA may be discharged from an acute-care setting to a nursing home/extended-care facility or to home with a positive MRSA culture; these facilities may **not** refuse admission to such patients. However, if a patient known to be colonized or infected by MRSA is transferred to another health care facility, the receiving facility must be notified verbally **in advance** that the patient is colonized or infected with MRSA. In addition, **written** communication (e.g., on the patient transfer form) that the patient is colonized or infected with MRSA **must** accompany the transferring paperwork to the receiving institution (see Appendix A.)

3. Nursing Home/Extended-Care Admission

Patients colonized with MRSA should not be denied admission to any nursing home/extended-care facility. Methicillin-resistant *S. aureus*, along with many other resistant bacteria, may be present in any patient. Strict attention to handwashing with all patients is indicated at all times.

The MRSA colonized patient can be placed with another colonized patient if one has been identified, but this is not mandatory. However, the patient should not be placed in a room with a patient who is at high risk for MRSA infection (i.e., tracheotomy, gastrostomy tube, urinary catheter, severe underlying disease or immunocompromised).

A patient with clinical MRSA infection can be admitted to a nursing home/extended-care facility under special circumstances, if the patient's medical treatment regimen can be carried out at that facility and if familial consent, and nursing home administration agree.

4. Discharge to Home

Patients colonized and/or infected with MRSA may be transferred to home if families and/or home health care services are equipped to manage wound and necessary antibiotic therapy. If the patient is to be discharged from an acute-care or nursing home/extended-care facility to a private home, there will be a need to educate the family that there is a difference in risk between MRSA infection in the setting of a health care facility versus the home setting. The patient's family will invariably have noted the extraordinary attention to infection control practices while their relative was hospitalized or in the nursing home/extended-care facility and will be concerned (1) that they will be required to duplicate these infection control practices in the home setting, and (2) that they themselves will be at high risk of transmission of MRSA to the numerous hospitalized highly susceptible patients/residents, especially those who have open wounds, invasive devices, or severe underlying disease.

The patient's family members/caretakers need to understand that extraordinary infection control measures, beyond good handwashing and careful handling of soiled dressings, are not necessary in the home; if there is a highly susceptible family member (e.g., child with cystic fibrosis or immunocompromised patient), more extensive precautions might be in order. Because of the lack of selective antibiotic pressure in the home setting, even if family members and/or caretakers become transiently colonized with MRSA, they will usually not remain permanently colonized. It is important for the nursing case manager or discharge planner of the patient being discharged to assess the home situation and address any issues involved in providing a safe environment for the patient and/or family members/caretakers.

B. PREVENTION AND INFECTION CONTROL

1. Prevention of Antibiotic Resistance

It has been noted that some outbreaks of MRSA in nursing homes/extended-care facilities have followed indiscriminate use of some broad spectrum oral antibiotics. Although the literature does not definitely prove this association, it is prudent to avoid using antibiotics on all patients unless absolutely necessary. When antibiotic therapy is needed and if the situation is appropriate, narrow-spectrum antibiotics should be selected rather than broad spectrum antibiotics.

2. Skin Breakdown

Since most MRSA infections are associated with decubiti and other skin breakdowns in adults and tracheostomy and gastrostomy sites in children, attention must be paid to maintaining the skin integrity of all patients.

3. Infection Control

a. General Information

Infection control measures to prevent transmission of MRSA are no different from measures to prevent person-to-person spread of any other pathogen. The measures are referred to as Body Substance Isolation (BSI). The wounds, blood and body fluids of **ALL** patients, regardless of the diagnosis, are viewed as potentially infectious. This includes precautions in handling any patient's body secretions, mucous membranes, or non-intact skin. These procedures must be followed by all providers of direct patient care.

b. Handwashing

Handwashing is the single most important measure **necessary to control the spread of MRSA**. Hands should be washed employing proper handwashing technique using a liquid soap and warm running water for 15-20 seconds.

Proper handwashing should be performed:

-Before and after any patient contact that is more than incidental (Example: Turning a patient requires handwashing but adjusting the IV regulator does not);

-After completing a dirty task and before starting a clean one (e.g. after cleaning a bed when a patient is discharged and then putting on clean sheets).

-Between care for different anatomical sites on the same patient;

-Before and after gloving;

-After handling soiled equipment, dressings and clothing;

-Before and after eating and/or drinking or preparing food;

-After using the toilet; and

-At the beginning and end of the work day.

c. Barriers

Protective barrier devices must be worn when contact with blood and body fluids is likely.

-Gloves

Gloves should be worn when hands may come in contact with mucous membranes, non-intact skin, or blood and body substances or when the caregiver has cuts, lesions or dermatitis. Gloves should be changed between patients and tasks. Gloves are not needed when delivering supplies or medicines, shaking hands or touching intact skin.

-Gowns/Aprons

If a person's clothes or uniforms are likely to become soiled with blood or body fluids, then some type of impervious protective clothing, such as an appropriate gown or apron, should be worn.

-Masks, Safety Glasses, Goggles, and Face Shields

Masks or other face protectors do not need to be worn for routine contact with patients with MRSA infections. A mask should be worn when airborne or droplet infection is anticipated. If splatters or splashes are anticipated, a mask and goggles or face shield should be worn. These protective devices should also be used while cleaning contaminated instruments and equipment.

d. Environmental

-Medical Equipment

Medical items of patients with MRSA such as wheelchairs, blood pressure cuffs, etc. should be cleaned on a routine schedule or when visibly soiled. Since these items usually come in contact with skin that is covered or intact, low level disinfectant is acceptable to inactivate the bacteria.

-Linens and Clothing

No special precautions are required for laundering personal on institutional linen used in the care of patients with MRSA infections. Contaminated items should be handled in a manner to prevent contaminating healthcare employee's clothing.

-Cleaning of patient areas

Daily routine cleaning should be done in all patient areas to reduce bacterial load. Cleaning should be done with a disinfectant registered with the EPA and performed in a sanitary manner as is done in all rooms regardless of the presence of MRSA. In particular, whirlpool baths should be cleaned according to recommendations with an EPA-registered antimicrobial solution after each patient.

-Patient Waste

Inasmuch as fomite transmission of MRSA generally does not occur, patient waste may be disposed of in an ordinary sanitary manner which is appropriate for all medical waste.

e. Restriction of activity for MRSA-Positive Patient/Residents

In most cases, an MRSA-patient (colonized or infected) can be permitted to ambulate and socialize in other sections of the facility and can participate in group activities. This is generally permissible as long as any open wound or tracheostomy site can be well-covered and the patient/resident understands and practices good hygiene. A patient/resident who cannot reliably follow basic hygienic measures should not be allowed to ambulate or socialize without supervision.

f. Handling Infected or Colonized Employees

Patient-care providers who are colonized or infected with MRSA should be educated about the particular importance of handwashing.

Providers who are only colonized or who have infections that can be covered may continue to work except in certain high risk areas such as newborn nurseries or oncology wards as defined by facilities; providers with open infections that cannot be covered should be excluded from patient care until the infections are cleared.

In general, it is not necessary or recommended to treat colonized employees with antibiotics. It may be warranted in an outbreak situation to treat an employee who is epidemiologically-linked to the outbreak. This should be done only if the evidence implicating the employee as a transmitter is strong. Multiple specimens may be required in order to determine if the employee is really a part of the outbreak or is only transiently colonized. An epidemiologically-linked culture-positive employee should be counseled regarding infection control precautions and any deficiencies should be corrected first. Facilities that consider treating colonized employees should refer to the treatment section of these guidelines.

g. Home Health Agencies

Home health agencies should follow the general infection control and BSI recommendations outlined in this document.

C. SURVEILLANCE FOR MRSA

1. Recommendations on Culturing

Prospective surveillance for MRSA should be an integral part of any program designed to control the spread of MRSA.

Routine culturing of patients or staff for MRSA is not generally recommended. Patients should be cultured when it is medically indicated. However, during a MRSA outbreak, it may be necessary to culture patients or staff without medical indication in order to effectively define and contain the spread of the organism.

a. Situations when cultures may be warranted:

i. Cultures are recommended upon the appearance of clinical signs of tissue invasion including serosanguinous fluid (even in the absence of purulence), purulent drainage, erythema at the site of a wound, fever, elevated WBC count, or other manifestation of infection.

ii. At the present time, the literature does not recommend culturing wounds without clinical signs of infection, but this may be appropriate in the event of an outbreak situation in order to effectively contain the spread of the organism. **NOTE:** It is important to remember that most MRSA transmission within a facility has been associated with patient-to-patient spread on the hands of staff, and not with the organism colonizing a staff member.

iii. Culturing any wound site in individuals with a previous history of MRSA infection or colonization upon admission or readmission to a hospital or nursing home should be considered.

b. General Guidelines for cultures

Culturing should follow specific procedures for obtaining specimens which have been established by the bacteriology laboratory to which the specimen(s) will be sent. Gloves should be worn when obtaining specimens. Hands should be washed before and after obtaining cultures.

i. Nares (nose)

Culturing to establish colonization is generally not indicated. In outbreak settings, in which search for carriers is worthwhile, a culture should be obtained using one sterile swab moistened with sterile saline. The swab should be gently swirled in each anterior nares (the opening of each nostril) for 2-3 seconds. The same swab can be used for both nares. The swab should be placed in a transport system and labeled prior to shipping to a qualified laboratory for identification and susceptibility testing. The laboratory should be instructed to screen the specimen for MRSA only.

ii. Surface cultures of broken skin

Before a culture is obtained form broken skin (a decubitus ulcer, an open wound, a gastrostomy, or a tracheostomy site), the area should be wiped with a sterile gauze pad moistened with sterile saline. The site should then be swabbed with a sterile culture swab using a gently rolling motion. If the site is purulent, the culture should be obtained from the most heavily involved area. The anatomical site of the specimen(s) should be clearly indicated on the requisition slip.

iii. Culture of specimens with suspected deep tissue infections, vascular catheter infections, urinary tract infections, pneumonia and bloodstream infections

Standard laboratory protocols should be followed to obtain specimens for culture.

iv. Antibiotic Susceptibility Testing

At this time, susceptibility testing with MRSA may be misleading. *Staphylococcus aureus* **that is resistant to methicillin or oxacillin should be assumed to be resistant to all antibiotics other than IV vancomycin and possibly trimethoprim-sulfamethoxazole regardless of susceptibility test results.** The only antibiotic sensitivities that are of importance in determining antibiotic therapy for MRSA infections are penicillin, oxacillin, vancomycin and TMP-SMX. Sensitivity to other antibiotics should be used for establishing epidemiologic linkage only, not for clinical decision-making. To avoid confusion, institutions may want to consider reporting to clinical staff only sensitivities to these four antibiotics.

v. Phage typing

In general, phage typing is not necessary to evaluate MRSA isolates, since antibiotic susceptibility patterns can indicate epidemiologic linkage. However, in special circumstances when investigating possible nosocomial outbreaks phage typing can be helpful.

Phage typing can be obtained by request through the Louisiana State Office of Public Health. If there is a substantial increase in the incidence rate then phage typing may be considered after an initial investigation. Check with the Office of Public Health, Epidemiology Section for further assistance.

2. Date Collection and Analysis

a. Surveillance/Data Collection

Each acute and nursing home/extended-care facility should maintain a surveillance line-listing of the names and other appropriate information of current and past residents/patients who are known to be colonized or infected with MRSA. A sample surveillance line-listing can be found in Appendix B.

b. Analysis

A surveillance line-listing should be maintained and reviewed by the designated infection control person to monitor trends over time.

A method of analysis is to calculate the incidence rates of infections per 1000 patients days as follows:

$$\text{MRSA Incidence Rate} = \frac{\text{\# of active infections during the month}}{\text{\# of patient days for the month}} \times 1000$$

c. Use of Analysis

Based on the analysis of the data, an endemic or epidemic rate can then be determined. Case counts or rates should be reported to appropriate medical staff or committees. Large or sudden increases in the MRSA incidence rate should alert infection control and medical staff about breakdown of infection control procedures or an outbreak of MRSA.

d. Identification of an outbreak

An outbreak of MRSA is defined as three or more epidemiologically-linked cases of MRSA occurring within a 30 day period, or a substantial increase in the number of MRSA cases from the baseline endemic rate, even if cases are not epidemiologically-linked.

D. TREATMENT

1. General Recommendations

MRSA should be considered an infecting organism (as opposed to a colonizing organism or a contaminant) if the positive culture was obtained from a site showing clear clinical signs of tissue inflammation, e.g., purulent drainage, erythema, induration.

While serious MRSA infections, such as pneumonia or bacteremia, are ground for hospital admission, many less severe MRSA infections can be effectively treated in an extended-care facility such as a nursing home.

MRSA indicates resistance (some lab reports may read "oxacillin-resistant") to most antibiotics including all penicillins and cephalosporins. Based on recent literature showing the development of resistance to most of the agents which have been used, it is not recommended that any standing orders for the therapy of MRSA be implemented.

Resistance of MRSA to quinolones has emerged so rapidly that we do not recommend quinolones for treatment of MRSA infections (4).

2. Treatment regimens

a. Intravenous vancomycin has proven efficacy for infections caused by MRSA, even when other therapies have failed. The clinical response of the patient is the best measure of vancomycin efficacy. If the patient has not responded clinically, the possibility of therapeutic failure should be considered. **NOTE:** Treatment with vancomycin may not eradicate the carriage state, therefore in the absence of symptoms, the patient should be considered "colonized" rather than infected. Vancomycin is not absorbed orally.

The patient should be monitored appropriately for toxicity. Vancomycin can have serious side effects, especially in the elderly. These side effects can include ototoxicity (hearing loss or vestibular toxicity), the less likely complication of nephrotoxicity (damage to the kidneys), and allergic reactions such as fever or rash. Many reactions with vancomycin, however, do not denote allergy, but rather may be manifestations of histamine release. These include hypotension and the "red man syndrome" (36).

b. Vancomycin plus rifampin and/or gentamicin

c. Trimethoprim-sulfamethoxazole --This antibiotic can be used in situations

when disease is a minor enough nature (such as minor episodes of furunculosis, limited non-emergent areas of cellulitis, or superficial decubitis ulcers) to allow for the use of oral antibiotics or when allergies or adverse reactions occur that preclude the use of intravenous vancomycin (9).

d. New agents for the treatment of invasive MRSA infections are in the development or trial phases. Teichoplanin is a glycopeptide antibiotic compound related to vancomycin that may be given intramuscularly and has a long half-life. However, many bacteria which have demonstrated resistance to vancomycin have also shown cross-resistance to teichoplanin. Daptomycin is a lipopeptide antibiotic that is similar to vancomycin in structure and spectrum. Daptomycin inhibits teichoic acid and lipoteichoic acid synthetic pathways.

e. It is unclear whether it is necessary to use any anti-staphylococcal antibiotics in the therapy of recurrent *S. aureus* furunculosis (1). Because of this, there may be the potential in certain patients who are not acutely ill for management without antibiotics of these infections using such local therapy as hot packs or incision and drainage and good infection control measures. Since this therapeutic protocol has not been definitively proven for infections caused by MRSA, clinical judgment should be exercised before making such decisions regarding therapy.

3. Recommendations Regarding Decolonization

a. General Recommendations

Decolonization refers to treatment of colonized persons with antibiotics or other measures to eradicate the organism from the site of colonization (usually skin and mucous membranes).

Current literature has not conclusively demonstrated that routine decolonization of a person colonized with MRSA is an effective method of infection control (3,6,8,9,14,35). Treatment of the carrier state among hospital staff, by itself, appears to have no effect on the spread of MRSA. Additionally, numerous studies of the effectiveness of various antibiotic or antiseptic regimens have failed to provide adequate proof of the overall usefulness of decolonization. It has been suggested in the literature that "decolonization should not be employed in nursing home settings unless

patient-to-patient contact can be minimized or eliminated, and even then, the ability of the current regimens to eliminate the carrier state in this population must be considered uncertain" (35). However, there may be medical reasons for the elimination of colonizing MRSA:

- If an outbreak (see definition) and if, upon appropriate laboratory and epidemiological analysis, it appears that a patient or staff member is epidemiologically-linked with an outbreak of MRSA, decolonization may be considered.

- If patients who are colonized with MRSA are immunocompromised or are more likely to spread the organisms due to behavior e.g., developmentally disabled or confused, decolonization should be considered. However, even in these patients, the current literature has not conclusively demonstrated that routine decolonization is effective.

- Decolonization may be used to prevent another recurrence of infection in a patient who has had repeated infections caused by the same strain. (**NOTE:** This does not pertain to those that are only colonized and have never developed infection).

b. Decolonization regimens

Numerous antibiotics, either used alone or in combination with others have been used to manage the carrier state with generally poor or inconsistent results. Antiseptics (chlorhexidine, hexachlorophene, povidone-iodine) have been used in handwashing, bathing, and shampooing to remove resident MRSA. Currently, there is little or no consensus as to the most effective way to eradicate colonizing MRSA. Specific treatment regimens for decolonization (e.g., treatment of an epidemiologically associated index case) should be made on a case-by-case basis. Some institutions may want a medical staff committee to make recommendations regarding appropriate medical treatment.

It must be understood that the use of antibiotics may prolong the carrier state. Treatment of colonization is not without complications. Failure to eradicate colonization may result in a broader pattern of resistance in the MRSA than was present prior to the attempt at decolonization. Indiscriminate use of agents to eradicate colonization potentially creates a strong selective pressure that could encourage emergence of resistance.

There is evidence that suggests that nasal application of mupirocin, as well as

the use of rifampin in combination with another drug (such as TMP-SMX, clindamycin, ciprofloxacin) may be effective for decolonization. It should be noted however, that repeated use of these agents and sometimes even initial use of these antibiotics have resulted in the emergence of resistance.

c. Staff member colonized with MRSA

Routine decolonization of staff is not recommended. If MRSA is spread within institutions, it is generally by transfer of organisms from an infected patient to the hands of employees and then to another patient. These employees carry the organisms only transiently; they are not colonized. Because of this, decolonization is unlikely to impact nosocomial spread and must not replace well established principles of infection control and hygiene.

E. LABORATORY CONSIDERATIONS

The clinical laboratory is an important component of the health care system. The importance of accurate and reliable laboratory results in health care is unquestioned. Laboratories can be of great assistance in detection of MRSA, so many assume that all such infections are diagnosed using the microbiology laboratory. However, this may not always be the case. Specimens may not be collected for all suspected MRSA, and if a specimen is collected, an etiologic agent may not be identified. Furthermore, a positive laboratory report does not mean the patient has MRSA infection. Isolation of a pathogenic organism may merely represent colonization of the patient by the organism. To accurately interpret laboratory findings, clinical and historical data are needed to confirm the identification of MRSA. Therefore, laboratories can be of benefit in surveillance activities, but laboratory reports are not sufficient for the identification and confirmation of MRSA infection. A cooperative working relationship between the laboratory and infection control practitioner is essential to assess MRSA activity in any facility. This section addresses considerations in the laboratory's role in MRSA.

To assure reliability and dependability of lab results, infection control practitioners should look for the following features in a laboratory:

1) Laboratory certification (according to national standards)
2) Qualified and experienced staff
3) Proficiency testing
4) High volume of cultures
5) Multiple-physician use

Culture and susceptibility testing methods for identification of Staphylococcus aureus should be performed as established by the National Committee of Clinical Laboratory Standards (NCCLS). Upon submission of isolates for MRSA identification, labeling the specimen "MRSA suspect" may expedite and bring attention to proper handling of specimens. In turn, the laboratory should provide reports that should be easy to read, available in one specific location, and reported in a timely fashion.

If laboratory results are inaccurate or misinterpreted, they can lead to problems with clinical care. These problems may occur if there is underreporting or overreporting. Underreporting---Misreporting of MRSA as sensitive may result in:

1) ongoing colonization/infections unresolved with the prescribed antibiotics to which it was sensitive
2) extensive antiobitic therapy with accompanying side effects and emergence of resistance
3) 'seeding' of staff (colonization ongoing from unrecognized/undiagnosed persons to other patients and staff)
4) extensive cost in treating/isolating/eliminating infection

Overreporting---Methicillin-sensitive *S. aureus* reported as MRSA may result in:

1) unnecessary treatment and toxicity risks
2) emergence of vancomycin resistance
3) increased patient costs-physically and financially
4) over-isolating or pseudo-outbreak

Misinterpretation of laboratory results often occurs when Methicillin Resistant *S. aureus* is confused with Methicillin Resistant *S. epidermidis* (normal skin flora).

MRSA may not be recognized in culture if:

1) More than one subspecies is present and a sensitive species dominates.
2) Quality of culture does note permit isolation and growth.
3) Other organisms overgrow staphylococci.

KEY INFORMATION ON LAB REPORTS IN IDENTIFYING MRSA

GENUS – Staphylococcus
SPECIES – Aureus
COAGULASE POSITIVE STAPHYLOCOCCI
SENSITIVITY OR SUSCEPTIBILITY REPORT – (S) sensitive; (R) resistant
ANTIBIOTIC – OXACILLIN (R) resistant

F. MANAGEMENT OF OUTBREAKS

When an outbreak is recognized, immediate reinforcement of infection control procedures (e.g., handwashing and BSI) to all staff is necessary. All patients in the unit or wing where the cases have occurred may need to be cultured for MRSA.

Personnel should be cultured only if symptomatic or epidemiologically-linked to transmission. In those situations, cultures should include the nares and any skin lesion. Culture-positive staff should be assessed on a case-by-case basis using the Employee Health Guidelines of the institution.

During an outbreak, all MRSA infected patients should be physically separated from MRSA-negative patients with no staff crossover between the two groups (cohorting). Strict cohorting may not be achievable, but efforts to minimize the number of persons caring for MRSA-positive patients/residents should always be a goal. Two consecutive negative cultures 24 hours apart obtained 48 hours after completion of antibiotics are grounds for release from cohort.

Decolonization of patients or staff is not routinely recommended. This has not proven to be an effective control measure, because recolonization occurs. However, if staff are found to be epidemiologically-linked to the outbreak, decolonization may be considered (see Recommendations regarding decolonization).

Careful surveillance for additional infection or colonization should be undertaken. Weekly patient assessments on previously infected MRSA patients in extended-care facilities may be warranted.

Epidemic analysis of the outbreak should be made, including collecting information on all MRSA-infected patients such as:

1. Patient's location in the institution (before and after cohorting);
2. Date of admission and recent previous admissions;
3. The names of caregivers who have had direct contact with the patient;
4. Body site of infection or colonization;
5. Age, sex, and race;
6. Diagnosis; and

7. Treatment given.

These factors should be evaluated for the group of MRSA-infected patients to look for common features which may lead to specific control strategies.

During a MRSA outbreak, there are no reasons a nursing home/extended-care facility or hospital should restrict the transfer of patients between facilities or be closed to new admission, provided there is room. Nursing homes/extended-care facilities may continue to discharge patients, provided the guidelines for admission/discharge are followed. However, restriction of admissions or discharges should occur if it is determined that the facility is not following the proper protocols in caring for the residents already in the facility.

III. CONTINUING EDUCATION

Open and adequate communication among health care providers is essential to the implementation of these guidelines. A key element in communication is knowledge about MRSA: its epidemiology, treatment, and control measures in all types of clinical settings.

It was the Louisiana State MRSA Advisory Committee's charge to identify a lead agency or organization who would take responsibility for developing a statewide network of trainers who could provide inservice training to health care personnel and other concerned individuals. Individuals/groups who will be targeted for MRSA training will include: institutional staff (nursing assistants, housekeepers, nurses, etc); nursing students, physicians, ombudsmen; patient and family members; social workers; state agencies' staff; legislators; and the public.

It is been suggested that the four Louisiana Chapters of the Association of Practitioners in Infection Control assume the leadership role in this endeavor. The Office of Public Health personnel and the Louisiana State MRSA Advisory Committee will also be available to assist. Additionally, it has been recommended that the LSU Medical School's Infectious Disease Department act as a medical resource as needed for physicians regarding effective MRSA treatment issues.

The State MRSA Advisory Committee will develop the objectives (see Appendix C) and course content for the training. This committee will assist the Association of Practitioners in Infection Control in coordinating a network of "train the trainer programs" which will consist of other members of the health care community. These "trainers" will serve as providers of educational in-service programs regarding MRSA. In addition, the State MRSA Advisory Committee will assist in the development of audio-visual aids (videos, slides, etc.), outline, and literature for the team's use.

APPENDIX C

MRSA LEARNING OBJECTIVES

Upon completion of the (videotape, presentation, learning booklet, or whatever method(s) used), and without access to reference notes and materials, the learner should be able to perform the following with 90% accuracy:

1. MRSA DISEASE PROCESS

    1.1 Explain who is at highest risk for MRSA infection. (patients with decubiti or other skin breakdown, patients with a tracheotomy, gastrostomy, urinary catheter, severe underlying disease, or immunocompromisation)

    1.2 Describe at which body locations MRSA can typically be found. (nares, sputum, urine, open wound, skin)

    1.3 Identify and explain the most common method of transmitting MRSA. (person to person contact, usually by contaminated hands)

    1.4 Identify and explain the difference between a carrier of MRSA and a person infected with MRSA. (clinical manifestations of infection or invasive disease)

    1.5 Identify clinical manifestations that might be signs of MRSA infection/invasive disease. (carbuncles, boils, elevated WBC count, erythema, drainage from skin break)

    1.6 Identify 3 sites that carry potential for infection with MRSA. (gastrostomy, urinary catheter, IV site, surgical incisions, virtually any break in the skin integrity)

2. TREATMENT

    2.1 Distinguish between three antibiotics consistently shown to be effective or ineffective in treating MRSA. (ineffective-nafcillin, oxacillin, penicillin, methicillin; effective-vancomycin)

2.2 Understand the most important aspect of antibiotic use that affects the development of new resistant strains of bacteria. (indiscriminate overuse of antibiotics, especially if broad-spectrum, contributes to the increasing development of new resistant strains of bacteria

2.3 Discuss adverse side effects of Vancomycin. (ototoxicity-hearing loss or vestibular toxicity; nephrotoxicity; allergic reactions-rash, fever, anaphylaxis; redman syndrome of histamine release)

2.4 Examine the rationale for IV (vs IM, PO) use of vancomycin. (extravasation into subcutaneous tissue causes extreme pain and possibly necrosis; oral vancomycin is ineffective)

2.5 Understand why vancomycin must be administered over a minimum of 60 minutes and as a dilute solution. (potential incidence of adverse reactions such as thrombophlebitis will be reduced as well as, decreasing the incidence of "red man's syndrome")

2.6 Describe two specific adverse reactions that are felt to be related to speed of infusion, rather than true drug reactions. (red man syndrome; hypotension)

2.7 Identify the specific times to draw peak and trough levels. (trough-just prior to administration; peak 1-2 hours after completion of infusion)

2.8 Describe specific underlying physical problem of a patient that would indicate the need to administer a reduced dosage of vancomycin. (reduced renal function because of potential nephrotoxicity; underlying liver disease because of reduced ability to process; severe immunocompromisation may need to be evaluated prior to administration)

2.9 Discuss specific concommitant/sequential drugs that, if used in conjunction with Vancomycin therapy, generate an increased need to monitor the patient with the utmost of care. (other potentially nephrotoxic and/or neurotoxic drugs, such as amphotericin-B, aminoglycosides, bacitracin, polymixin B, colistin, viomycin, cisplatin, IV erythromycin, and IV Lasix)

2.10 Identify at what time MRSA infection warrants hospital admission. (Not

all infections warrant hospitalization. Hospitalization should be considered when the attending physician and the health care team deems necessary for treatment; especially for severe infection-pneumonia or bacteremia. Treatment can be provided within an extended-care facility or home if the clinical manifestations of infection show signs of improvement and the facility is equipped to manage the wound and necessary antibiotic therapy.)

2.11 Discuss at what time MRSA infection warrants intravenous vancomycin treatment. (For serious infections such as pneumonia or bacteremia or when medical exam results deem necessary. Most MRSA infections are superficial wound or skin lesions and other methods of treatment and infection control measures may prove sufficient.)

2.12 In communicating with the laboratory concerning a suspected MRSA culture specimen, identify at least one aspect of information most important to give the lab. (NARES-screen for MRSA only; indicate anatomical site from which specimen was derived)

2.13 Discuss 2 situations in which decolonization is recommended. (during an outbreak, if epidemiological link is seen; when individual case study indicates likelihood of spreading organism to other due to unchangeable behaviors; to prevent another recurrence of infection in pt who has had repeated infections caused by the same strain; immunocompromised patient) **NOTE**: Nothing should preclude good infection control practices.

3. INFECTION CONTROL

3.1 Identify the single most important practice to prevent spread of MRSA (routine handwashing)

3.2 Understand the focus of a surveillance program aimed at MRSA. (determination of new cases, distribution in a facility, temporal relationship of case, proximate relationship of cases, etc.)

3.3 Understand when routine culturing of for MRSA may be recommended. (during an outbreak situation in an attempt to control spread of disease; at the appearance of clinical signs of tissue invasion; upon admission or readmission to a facility if there is a previous history of MRSA infection)

3.4 Identify and explain situations in which culturing of a patient for MRSA is

indicated. (appearance of clinical symptoms-tissue invasion, purulent drainage, erythema at wound site, fever, elevated WC count, etc.)

3.5 Identify two important infection control procedures to be used by the person when culturing a wound. (handwashing, gloving)

3.6 Discuss two points regarding infection control that should be stressed to the family (caretakers) of a patient being discharged to home. (handwashing, difference between hospital practices and home practices; importance of maintaining skin integrity; body substance isolation)

3.7 Summarize 4 items related to patient care at which proper handwashing is required. (before & after patient contact that is more than incidental [incidental is touching an IV line/non-incidental is turning a patient]; between care for different anatomical sites on the same patient; before and after gloving; after handling soiled equipment, dressings, and clothing; after using the toilet; at the beginning of the work day; before and after eating or drinking or preparing food)

3.8 Describe "barrier protection". (concept of protecting either or both the patient and the HCW by use of a layer of artificially fabricated protection –i.e. gowns, masks, face shields, gloves)

3.9 Identify 3 different types of barrier protection. (gloves, gowns, safety goggles/face shields/masks)

3.10 Identify at least one time in which the use of the above barrier protection is recommended. (all types if expecting explosive drainage or extensive close contact with patient; gloves-when anticipating contact with mucous membranes, non-intact skin, blood or body substance contact when HCW has open cuts, lesions, or dermatitis; masks if airborne or droplet infection is present)

3.11 Identify and explain three KEY actions that can be taken by health care professionals to prevent the spread of MRSA. (good handwashing technique and practice; universal precautions; communication between/among institutions)

4. PATIENT TRANSFER

4.1 Identify one of the two factors necessary in order to discharge a hospitalized patient who has completed appropriate treatment for MRSA infection. (clinical manifestations have disappeared; treatment completed or infection improved to the point that local or oral therapy in an extended-care facility or other setting)

4.2 Identify the specific time in the discharge/transfer process by which the receiving unit/institution must be notified if the patient's either colonized or infected with MRSA. (in advance)

4.3 Explain the specific manner (how) in which the receiving unit/institution Should be notified if the patient's either colonized or infected with MRSA. (verbally in advance)

4.4 Understand what must be included in the written paperwork being sent with the discharged patient to the receiving institution. (written notice of pt's colonized or infected status must be included in the patient transfer form)

4.5 Identify under what circumstances (related to MRSA colonization or infection) can a patient be refused by a receiving institution. (Never for a colonized patient and only if the facility is not equipped to manage the wound and necessary antibiotic therapy required for an infected patient.)

4.6 Identify at what time it is appropriate to transfer a patient known to be colonized or infected with MRSA without communicating this information to the receiving institution. (Never-advance verbally; written to accompany patient)

GLOSSARY

BODY SUBSTANCE ISOLATION

An infection control measure used to prevent transmission of infectious organisms form person-to-person.

CARRIER

A person who is colonized with methicillin-resistant Staphylococcus aureus (MRSA). The organism may be present in the nares (nose), sputum, urine, an open wound, in the stool or on the skin without clinical manifestations of disease. A carrier may transmit the organism to another person through direct contact, usually by contact with hands.

COHORT

A group of MRSA positive patients (infected or colonized) who a physically separated, grouped together (as much as is architecturally allowed) during an outbreak and cared for by staff who do not care for MRSA negative patients.

COLONIZATION

Presence of MRSA on tissue without the presence of symptoms or clinical manifestations of illness or infection. A carrier is a person who is colonized with MRSA.

DECOLONIZATIONS

Elimination of MRSA carried by persons through the use of infection control measures and/or antibiotics.

ENDEMIC RATE

The usual rate or prevalence of persons infected and/or colonized with MRSA in a facility. The endemic rate in each facility will be unique.

EPIDEMIC

See Outbreak

EPIDEMIOLOGICALLY-LINKED

The finding of a factor or factors that may relate to the spread of MRSA and that are shared by patients with MRSA, e.g., care by a common infected employee, sharing a room.

ERADICATION

Elimination of infections and/or colonization of MRSA in a facility through implementation of infection control and hygiene measures and/or antibiotics.

FOMITE

An inanimate object that may become contaminated by pathogenic organisms, such as MRSA. Examples include stethoscopes, blood pressure cuffs, handkerchiefs, bed linens, and clothing.

INFECTION

Invasion and multiplication of MRSA in tissue with the manifestation of clinical symptoms of infections such as increased white blood cell count, fever, lesions, boils, drainage from a break in skin continuity, and erythema.

INVASIVE DISEASE

Clinical manifestations of symptoms caused by MRSA such as furuncles, boils, pneumonia, carbuncles, septicemia, or osteomyelitis.

INVASIVE SITE

Any place on an individual's body where the normal skin or mucous membrane barrier is broken, either by natural or artificial means, including decubitus ulcers, surgical incisions, intravenous or urinary catheters, and feeding gastrostomy or jejunostomy sites.

MRSA (METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS)

A gram-positive bacteria that grows in clusters like grapes and is coagulase positive and is resistant to methicillin and other semisynthetic antibiotics (e.g., nafcillin and oxacillin) that are effective against most strains of *S. aureus.*

NOSOCOMIAL INFECTION

An infection acquired in a hospital, nursing home, or other health care facility.

OUTBREAK

In hospitals: Three or more cases of epidemiologically-linked MRSA infections within 30 days of hospitalization

In nursing homes/extended-care facilities: Three or more cases of epidemiologically-linked MRSA infections within a 30 day period, OR any substantial increase in number of cased from the endemic rate even if not epidemiologically-linked.

SA (*Staphylococcus Aureus*)

A gram-positive bacteria which grows in clusters like grapes and is coagulase positive; SA may be sensitive to methicillin, cephalosporins, nafcillin, and oxacillin, in which case it is referred to as MSSA (methicillin-sensitive *Staphylococcus aureus*).

SURVEILLANCE

Monitoring of patient data at regular intervals to determine the number and characteristics of new infections and distribution within a facility.

SUSCEPTIBILITY TESTING

The laboratory tests used to determine if an organism can be effectively treated with particular antibiotics. Patterns of antibiotic susceptibility of MRSA isolates can be used to indicate epidemiologic linkage and identify outbreaks. The only antibiotic susceptibility tests that are of importance in determining antibiotic therapy for MRSA infections are penicillin, oxacillin, vancomycin and TMP-SMX.

TRANSMISSION

The passage of MRSA from a colonized or infected individual to a person previously free of the organism.

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